



# STS-93

## Commercial Generic Bioprocessing Apparatus: Working with Biology for the Marketplace

In microgravity, many biological processes are changed. For example, plants grow differently because they produce less lignin — a structural material — than those on Earth, and microbial growth is increased which could lead to increased production of important compounds. Understanding and harnessing these changes so that new or improved products or methods of production can be obtained, to the benefit of the U.S. public and industry, is the goal of commercial research being done in the Commercial Generic Bioprocessing Apparatus. This facility, developed by BioServe Space Technologies, a NASA Commercial Space Center, allows a variety of sophisticated bioprocessing research to be done using a device called a Fluids Processing Apparatus (FPA).

The FPA is a “microgravity test tube” consisting of a glass barrel containing several chambers separated by special rubber stoppers. Processing occurs within the cylinder when a plunger is used to mix the contents together. Eight FPAs are placed in a Group Activation Pack (GAP), which allows all of the research to be started and stopped at the same time when an electric motor turns a crank. Eight GAPs, or similar sized devices, can be stored in a single CGBA temperature controlled locker.



Courtesy: BioServe Space Technologies

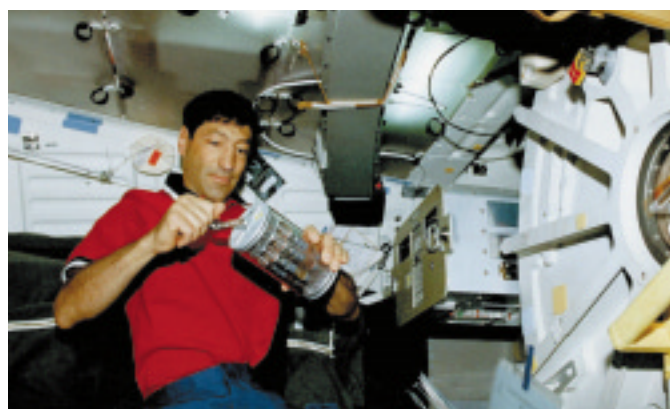
*The Fluids Processing Apparatus is essentially a “microgravity test tube” that allows a variety of complex investigations to be performed in space.*

CBGA on STS-93 represents a good example of collaboration between commercial and science research initiatives. Within the CGBA payload will be two lockers dedicated to commercial research. A third locker will be primarily used to support National Institute of Health (NIH) funded science research, with flight sponsorship being provided by the NASA Life Sciences Program.

The commercial research will cover the following areas:

**Water Purification:** Because bacteria behave differently in microgravity, the growth of bacteria can be harder

to control. Developing better systems on orbit to counter bacterial growth leads to improved purification technologies on Earth. From previous microgravity research, investigators have developed improved systems ranging from small units that can be carried by hikers to larger systems that can be used by municipalities or in disaster relief operations. The investigations on STS-93 by Water Technologies Corporation/WTC-Ecomaster will test a new generation of iodine impregnated resins for effectiveness and look at improving waste treatment through the use of bioprocessing microorganisms.



*Manual activation of 8 FPAs in an earlier version of the Group Activation Pack during a previous mission.*

**Pharmaceutical Screening:** The recruitment by the body of white blood cells (leukocytes) from the blood stream is a critical event in successfully fighting infections. In microgravity, the immune system function is inhibited, which may mimic immune system impairment among certain patient populations. At least two aspects of white cell recruitment have been identified that may be linked to this inhibition of the immune system. The objective of this research, by Ligocyte Pharmaceuticals, Inc., is to characterize white blood cell adhesion in reduced gravity, which may lead to improved pharmaceuticals used to treat stress induced immunosuppression and help prevent undesirable side effects common with current treatments.

**Dynamic Control of Protein Crystallization:** Protein crystals, shown to be of frequently higher quality when grown in microgravity, are used to design drugs based on the molecular

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structure of the protein. BioServe, in conjunction with BioSpace International, Inc., is investigating methods of further enhancing the quality of space-grown crystals by actively monitoring and controlling the chemical environment surrounding the growing crystals.

**Space Technology and Research for Students (STARS):** How many aphids can a ladybug eat in microgravity? This experiment, proposed by students at the all-girl Javiera Carrera High School in Santiago, Chile, seeks to answer the question so that a comparison can be made with behavior on Earth. The experiment consists of three clear plastic boxes, each containing four wheat stalks (*Triticum aestivum*) infested with 30 aphids (*Rhopalosiphum padi*) per stalk. Once on orbit, a crewmember will release two ladybugs (*Eriopis connexa*) apiece into two of the boxes. The third box, without ladybugs, is the control. Cameras trained on the two boxes with ladybugs



*Chilean student Natalia Ojeda tends wheat being grown in a ground-based version of the STARS flight experiment.*

will record ladybug and aphid activity at least three times a day during the five-day mission.

The images will be downlinked to Earth where they will be put on the Internet for students to download. The

Chilean students will exchange notes in a special chat room with

other students from Baseline Middle School in Boulder, Colorado, Huron High School in Ann Arbor, Michigan, League City Intermediate School in League City, Texas, St. Margaret Mary in Winter Park, Florida, and Western Reserve Acadmeny in Hudson, Ohio, who will all be repeating the experiment on the ground. BioServe Space Technologies is providing the hardware and has overall payload responsibility, the Environmental Research Institute of Michigan provided initial development of the experiment, SPACEHAB, Inc. is providing support and coordination, and J. Weston Walch is writing and publishing commercial educational materials based on the experiment, which will be a prime product of the experiment.

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FS-1999-06-71-MSFC